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Strategies to increase production efficiency in Indonesian Sharia commercial banks using Stochastic Frontier Approach (SFA)

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A B S T R A C T

The purpose of this research is to examine the right strategy in increasing production efficiency in Sharia commercial banks in Indonesia. This research was conducted in two stages of testing. The first stage is estimating the level of production efficiency of Indonesian Islamic banks in 2010-2017 through the Stochastic Frontier Analysis (SFA) approach. The second stage uses Tobit regression to examine the relationship between the efficiency of production of sharia commercial banks with specific bank characteristics, including; LASSET, CAR, NPF, GCG, NOM and FDR. The results indicate that the level of production efficiency of sharia commercial banks is strongly influenced by several things. From the input side, optimization of DPK, PSC and LC components is needed to maximize production efficiency. This study also found that CAR (solvency performance), NPF (asset quality performance), NOM (profitability performance), and FDR (liquidity performance) greatly influenced variations in the efficiency of Indonesian Islamic banks. Improving the quality of financing supported by an increase in the operational system and the quality of human resources and began to concentrate on revenue sourced from services to be a solution that could be implied by Indonesian Islamic banks.

A B S T R A K

Tujuan dari penelitian ini adalah untuk menemukan strategi yang tepat dalam meningkatkan efisiensi produksi pada bank umum syariah di Indonesia. Pengujian dilakukan dengan dua tahapan. Tahap pertama melakukan estimasi tingkat efisiensi produksi bank umum syariah Indonesia tahun 2010 - 2017 melalui pendekatan Stochastic Frontier Analysis (SFA). Tahap kedua menggunakan regresi tobit untuk menguji hubungan antara efisiensi produksi bank umum syariah dengan karekteristik spesifik bank, antara lain; LASSET, CAR, NPF, GCG, NOM dan FDR. Hasil penelitian mengindikasikan bahwa tingkat efisiensi produksi bank umum syariah sangat dipengaruhi oleh beberapa hal. Dari sisi input, optimalisasi pada komponen DPK, BBH, dan BTKL sangat diperlukan untuk memaksimalkan efisiensi produksi. Penelitian ini juga menemukan bahwa CAR (kinerja permodalan), NPF (kinerja kualitas aset), NOM (kinerja profitabilitas), dan FDR (kinerja likuiditas) sangat mempengaruhi variasi pada efisiensi bank umum syariah Indonesia. Peningkatan kualitas pembiayaan yang didukung oleh peningkatan sistem operasional dan kualitas SDM serta mulai berkonsentrasi pada pendapatan yang bersumber dari jasa menjadi solusi yang dapat diimplikasikan oleh bank syariah Indonesia.

1. INTRODUCTION

Towards the realization of ASEAN financial sector integration in 2020, the level of competition in the banking sector is getting stronger. Foreign banks will increasingly enter the Indonesian market more intensively by bringing their respective advantages, one of which is the price of competitive products and services. The prices of bank products and services are strongly influenced by the extent to which banks are able to manage their resources optimally or known as efficiency performance. Maximizing the efficiency of sharia banking requires a lot effort. The development of Islamic banking is considered to be less optimal both in terms of assets, variations

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in products and services, distribution of services to the number of banks and offices. The 2017 Sharia Banking Snapshot (Table 1) shows the slowdown in

Table 1
The Development of Indonesian Sharia Banking in 2013 - 2017

Indicator	2013	2014	2015	2016	2017
Sharia Banking					
Asset Growth (*yoy*)	24,24%	12,41%	9,00%	20,28%	18,97%
DPK Growth (*yoy*)	24,43%	18,53%	6,37%	20,84%	19,83%
Financing Growth (*yoy*)	24,82%	8,35%	7,06%	16,41%	15,23%
Market Share	4,89%	4,85%	4,88%	5,33%	5,78%
BOPO	78,21%	94,16%	94,38%	93,63%	89,62%
NPF (net)	1,75%	2,94%	2,77%	2,06%	2,13%
NPF (gross)	2,62%	4,33%	4,34%	4,15%	3,87%
CAR	14,44%	16,10%	15,02%	16,16%	17,91%
FDR	100,32%	91,50%	92,14%	88,87%	85,31%
Sharia Commercial Banking (BUS)					
Asset Growth (*yoy*)	22,21%	13,64%	4,13%	19,10%	13,31%
DPK Growth (*yoy*)	21,52%	19,24%	2,44%	18,02%	15,41%
Financing Growth (*yoy*)	22,13%	7,78%	4,07%	15,27%	6,94%
Number of Banks	11	12	12	13	13

growth in Assets, Third Party Funds (DPK), and Provided Financing (PF). Islamic banking also still recorded a low market share, which amounted to 5.78% of the national banking market share despite increasing by 0.45% from 2016. In addition, the strength of Islamic banks was still below conventional banks. SPI December 2017 shows that Sharia banks only have 1 banks BUKU 3, 9 banks BUKU 2 , and 3 banks BUKU 1. This amount is not comparable with conventional banking which has 5 banks BUKU 4, 26 banks BUKU 3, and 53 banks BUKU 2. One type of sharia banking, namely the Sharia Commercial Bank (BUS), also experienced a bad development of PF by recording growth of 15.27% in 2016 and weakening significantly in the position of 6.94% in 2017. The dominance of margin originating from financing experienced shrinkage and further weakened BUS profitability performance. Meanwhile, the growth of DPK BUS also slowed from 18.02% in 2016 to 15.41% in 2017. The high growth gap between FP and DPK shows that there is still a lack of BUS performance in managing optimally owned resources. Compared with the performance of conventional commercial banks (BUK), the development of BUS also looks less significant.

In terms of quantity, the 2017 Indonesian Banking Directory (DPI) records that there are only 13 BUSs among 103 BUKs. More limited BUS capital causes a low variation in financing segments and the distribution of services provided. Other things are differences in interest rates or profit sharing offered by BUK and BUS to customers. From the SPI and SPS data for the December 2017 period, it was found that the average profit sharing of deposits for deposits in BUS was 6.78%, greater than the interest rate at BUK, which was 6.73%. While the average financing margin for working capital in BUS is 15.25%, greater than the average BUK loan interest rate of 10.71%. This condition is considered to be one of the triggers of a slowdown in FP growth caused by the rationality of the people who prefer to borrow funds in the BUK and save their funds in the BUS.

Efficiency is a critical factor for banks to gain competitive advantage. Various studies on bank efficiency show that more efficient banks have substantial cost advantages and competitive advantages compared to less efficient banks (Berger & Humphrey, 1997). BUS that is more efficient will be able to manage funds more optimally and produce a lower percentage of financing margin. In addition, financing offered by BUS will be more varied and evenly distributed across various business sectors and regions in Indonesia. Thus, BUS will have the opportunity to compete with the dominance of BUK. This will certainly be one of the attractions that can increase BUS's competitiveness. Opportunities to increase the market share of Sharia banking will also be higher.

At present, the measurement of efficiency using the ratio approach (BOPO) is considered to be no longer relevant because it does not elicit

overall bank efficiency information. In simple terms, efficiency is the ratio between the amount of resources and costs that must be sacrificed to achieve the results of an activity. In other words, the results of optimal efficiency are achieved by using limited resources (Mongid & Muazaroh, 2017). BOPO does not produce overall bank efficiency information such as sources of inefficiencies (input and output) on BUS managerial up to factors that affect BUS inefficiencies both internally and externally. Zuhroh, et al (2015), in her research used a frontier approach to help solve the limitations of the ratio approach. The frontier approach that is widely used for efficiency measurement is the Data Envelopment Analysis or DEA approach (Repkova, 2015; Widiarti, et al, 2015; Singh & Fida, 2015; Sufian & Kamarudin, 2015; Shawtara, et al, 2015; Adusei, 2016, and Lema, 2017) and Stochastic Frontier Analysis or SFA (Zuhroh et al, 2015; Mongid & Muazaroh, 2017). The SFA approach is considered better because its measurement is based more on economic optimization than technical optimization (Berger & Mester, 1997). Zuhroh, et al (2015) also found that SFA was significantly more informative than DEA.

In an effort to find the right strategy to deal with business competition, BUS also need to understand the determinants that can affect bank efficiency. If based on PBI No.9 / 1 / PBI / 2007, the factors that need to be addressed by Sharia banks are capital, asset quality, management, profitability, liquidity, and sensitivity to market risk factors. Existing research, mentions the effects that vary between the above factors with efficiency.

The urgency to improve efficiency performance in Sharia banks as well as the consistency of the results of research in previous studies is a motivation to examine the determinants of cost efficiency in Islamic banks in order to determine the right strategy, especially to improve efficiency in BUS in Indonesia. This research was conducted in two stages of research where at First Stage, measurements will be made on the level of efficiency using the Stochastic Frontier Approach (SFA) method to determine the level of efficiency at Sharia commercial banks. While on the Second Stage, an analysis using Tobit Regression will be carried out to determine the determinants of efficiency levels in Sharia commercial banks through testing the influence of bank-specific characteristics.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

Production efficiency

Efficiency is a parameter that can be used to assess the extent to which a bank can optimize the management of its resources. Efficiency is not limited to pressing costs as low as possible, but involves managing input and output relationships, namely how to manage production factors (inputs) in such a way that they can provide optimal output. The approach used to measure efficiency in this study is the frontier approach. This is based on the frontier's ability to solve the limitations of the ratio approach (Zuhroh et al, 2015). Specifically, this study uses the Stochastic Frontier Analysis or SFA approach because it is considered more comprehensive when compared to other frontier approaches (Berger & Mester, 1997).

Banking Financial Ratio

PBI No.9 / 1 / PBI / 2007 states that the soundness of the bank is the result of qualitative and quantitative assessments of various factors that influence the condition or performance of a bank. These factors are capital, asset quality, profitability, liquidity, sensitivity to market risk and management factors. This study uses seven bank-specific characteristics to test the determinants of the production efficiency of BUS in Indonesia (Table 2).

In the macroeconomic framework, larger banks will be better able to enjoy economies of scale and economic spheres that make them enjoy lower average costs. (Mongid & Muazaroh, 2017). Banks with a larger size will have infrastructure in the form of resources, information technology, and organizational structures that support bank operational activities so that there will be increased efficiency in providing services, financing distribution, and providing public access to these banks. (Widiarti et al, 2015).

Capital performance was measured using the CAR ratio illustrates the ability of sharia commercial banks to absorb potential risks arising from the increase in productive assets through their capital. Banks with high CAR tend to be more efficient. This indicates that the capital strength of the bank is very capable of avoiding the bank from losses that cannot be borne. (Widiarti et al, 2015; Zuhroh et al, 2015; and Lema, 2017). Mongid & Muazaroh (2017) also found that banks with high CAR are highly reputable and can borrow from markets with lower interest rates. So that it will reduce the cost of bank funds (input efficiency).

Asset quality performance measured using the NPF ratio illustrates the quality of productive as-

sets owned by BUS. Increasing the NPF value indicates an increasing number of problematic financing. The increase in troubled financing will cause an increase in costs for the recovery of the financing. This indicates a cost inefficiency (Widiarti, 2015). On the other hand, NPF also shows banking credit (financing) risk. If the NPF increases, the potential for credit risk to increase also increases the capital that must be allocated to become a loss reserve. This can cause a decrease in profitability which in the end also causes a decrease in bank efficiency (Zuhroh et al, 2015; Sufian & Kamarudin, 2015).

Management performance measured using GCG ratios illustrates the quality of bank governance. The quality of good governance will bring about optimization of resource management, both bank input and output. BUS revenues will increase in line with increased production efficiency. Widiarti (2015) found that the implementation of GCG can reduce the potential of emerging credit risks. So if the implementation of GCG can run well, it can improve bank risk management as well.

Profitability performance is indicated by the NOM ratio. The increase in this ratio indicates that the bank has managed input management optimally, resulting in an increase in income which will ultimately improve efficiency performance. The high NIM shows banks can maintain the cost of funds and income from loans (Mongid & Muazaroh, 2017).Singh & Fida (2015) also found that banks with large capital and high profitability had higher technical efficiency.

Liquidity performance is indicated by the FDR ratio. The increase in this ratio indicates that there is an increase in the amount of financing provided by BUS, which means that Islamic banks are more optimal in utilizing the inputs they have (Third Party Funds). Banks with high LDR (FDR) will have higher income efficiency than other banks in the US (Berger & Mester, 1997). The Widiarti, et al (2015), Repkova (2015), Singh & Fida (2015), and Lema (2017) studies also show that FDR is an important parameter in bank efficiency.

Other capital performance also used in this study is the ETA ratio. The increase in this ratio indicates an increase in total productive assets owned by a percentage greater than the percentage increase in total assets. This will certainly increase revenue for banks and gradually reduce the presentation of unproductive bank assets. Decreasing unproductive assets will certainly reduce bank costs (Mongid & Muazaroh, 2017).

Table 2
Bank Factors

No.	Variable	Definition	Measurement	Hypothesis
1	PE	Production Efficiency, SFA	Score	
2	LASSET	Logarithm of Asset Size	Logarithm	Positive
3	CAR	Capital Adequacy Ratio (Total Equity/RWA)	Percentage	Positive
4	NPF	Non-Performing Financing (Bad Financing/Total Financing)	Percentage	Negative
5	GCG	Good Corporate Governance (GCG Composite Score)	Score	Positive
6	NOM	(Operating income - Operating Expenses)/Productive Assets	Percentage	Positive
7	FDR	Total Financing/Total DPK	Percentage	Positive
8	ETA	Earning Assets/Total Assets	Percentage	Positive

Table 3
Bank Sampling

No	Bank Name	Year of Establishment	Financial Statements	Bank Capitals 2017 (milions of rupiah)
1	PT. Bank BCA Syariah	2-Mar-2010	complete	1,139,884
2	PT. Bank BNI Syariah	21-May-2010	complete	3,729,820
3	PT. Bank BRI Syariah	16-Oct-2008	complete	2,452,308
4	PT. Bank Mega Syariah	27-Jul-2004	complete	1,148,780
5	PT. Bank Muamalat Indonesia	24-Apr-1992	complete	4,986,941
6	PT. Bank Syariah Mandiri	25-Oct-1999	complete	6,943,575

3. RESEARCH METHOD

This study documents the data of the annual sharia financial statements of Indonesian sharia banks during 2010-2017 sourced from the official website of the Indonesian OJK and each of the sharia commercial banks. Samples were chosen based on three criteria; (1) Standing before the 3rd quarter of 2010, (2) Having complete financial statements during the study period, and (3) Minimum status as a BUKU 2 bank. The final sample of this study consisted of six Islamic public banks and all data using the rupiah currency (Table 3).

***First Stage* (Stochastic Frontier Approach – SFA)**

This analysis is used to measure and describe the development of production efficiency levels in Sharia Commercial Banks which were used as research samples during 2010 - 2017. Production efficiency that is estimated by SFA is positive data which ranges from 0 - 1 or 0% - 100%. If the production efficiency score approaches the value of 1 or 100%, the bank is considered efficient, which means that it can maximize its profit with the resources it has and vice versa if the production efficiency score approaches 0 or 0%, the bank is considered unable to manage its resources efficiently. Before compiling the SFA frontier model, we must determine the input and output to be used (Table 4). Then the production efficiency score from the results of the SFA analysis will be called the dependent variable (Y) and regressed with the independent variable namely; LASSET, CAR, NPF, GCG, NOM, and ETA use tobit regression.

Table 4
Input and Output of Production Efficiency

Variables		Definition	Data Source
Input	LC	Labor Costs	Income Statement
	DPK	Total DPK	Balance Sheet
	TFA	Total Fixed Assets	Balance Sheet
	TE	Total Equity	Balance Sheet
	TOC	Total Operational Cost	Income Statement
	PSC	Profit Sharing Costs	Income Statement
Output	TF	Total Financing	Balance Sheet
	FI	Financing Income	Income Statement
	NFI	Non-Financing Income	Income Statement

Second Stage (Analisis Regresi *Tobit*)

The purpose of the next research is to identify bank-specific characteristics that can affect the efficiency of BUS. Tobit is a regression model that is designed to estimate the linear relationship between variables when censorship of sensor data occurs on the dependent variable (Y). The sensors used in the Tobit model are sensors up / right and sensors left / down (Tahir et al, 2012). The Y variable on the Tobit model must also be non-negative (Singh, 2015). The use of the Tobit model in this study is appropriate because data censorship will reduce the amount of deviant data or outliers that cause biased results. The following is a research regression model.

$$PE = \alpha + \beta 1LASSET + \beta 2CAR + \beta 3NPF + \beta 4GCG + \beta 5NOM + \beta 6FDR + \beta 7ETA + ei$$

Furthermore, the g test (likelihood ratio test) will be conducted to test the effect of simultaneous significance of all independent variables on the efficiency of sharia commercial banks and wald tests to test the partial significance of each independent variable on the efficiency of sharia commercial banks.

4. DATA ANALYSIS AND DISCUSSION

The Level of BUS Production Efficiency in Indonesia

The results of calculations of production efficiency performance using the SFA method shows that the efficiency of sharia commercial banks tends to increase with a positive trend of 0.06% during 2010 - 2017. The average value of production efficiency is 89.76% with a standard deviation of 7.69%. The next step is grouping the level of production into four categories (table 5) through measuring the quartile percentiles to assist the identification

process (Rahmawati, 2015).

Table 5
Category of Production Efficiency

Level of PE	Category
< 84	Not Efficient
84 - 91	Low Efficiency
92 - 95	Medium Efficiency
< 95	High Efficiency

Based on the results of the input and output efficiency regression, it is known that Total DPK (DPK), Profit Sharing Costs (PSC), and Labor Costs (LC) are components of the input variables that greatly influence variations in output efficiency. The right combination of input and output efficiency will certainly make it easier for sharia banks to achieve the highest efficiency. Optimizing DPK and PSC can be realized through competitive pricing. The price of financing offered by BUS tends to be higher than BUK. Funds will be hampered and result in a decrease in the margin of BUS. This condition is exacerbated by the PSC fees that must be paid. Optimizing aspects of DPK and LC can be rehabilitated through improved financing quality. As the frontline of banking, the role of HR is very crucial in order to minimize the risk of existing credit. This means that HR must have good product knowledge and good risk management capabilities to assess prospective debtors. Output optimization can also be increased through service revenues. In addition to the lower risk of loss, the characteristics of the community and the improvement of technology are opportunities that can be utilized by BUS. BCA Syariah and Mega Syariah as the two highest ranking banks have the ability to optimize returns on the management of their DPK. As a result, high PSC costs can still be accommodated with the return generated. BCA Syariah is also a combination of optimization of TPF and LC so that it achieves maximum average efficiency. On the other hand, Mumalat Indonesia as a third-ranked bank was able to outperform other sample banks by reducing its LC costs (table 6).

Determinants of BUS Production Efficiency in Indonesia

The first step that needs to be done in testing hypotheses is to test classic assumptions. This test is carried out to maintain the output quality of the research model used in this study, so that the resulting output is expected to have valid values and can be used as a reference in making decisions related to efficiency. This study uses four basic assumptions in the classic assumption test, namely; normality assumptions, multicollinearity assumptions, autocorrelation assumptions, and heteroscedasticity assumptions. The test results on the initial model of the study indicate that the regression model is not fit because there is a multicollinearity between the CAR and ETA variables. Re-modeling by removing the ETA is done because the ETA has the highest VIF value and Tolerance value. The second model is considered more fit because has passed the classical assumption test (Table 7). So the second regression model used is:

$$PE = \alpha + \beta 1LASSET + \beta 2CAR + \beta 3NPF + \beta 4GCG + \beta 5NOM + \beta 6FDR + ei$$

The results of the G statistical test in the Tobit regression indicate that the second model in this study is in the rejection area H_0. So that the research hypothesis can be accepted.

Table 6
Grouping the Level of Production Efficiency

Bank	PE	Rank	Category	Total Output	DPK	PSC	LC
Bank BCA Syariah	95.02	1	Medium Efficiency	100.00	100.89	6.34	2.24
Bank Mega Syariah	91.46	2	Medium Efficiency	100.00	91.40	6.04	4.38
Bank Muamalat Indonesia	91.05	3	Medium Efficiency	100.00	106.34	5.35	1.75
Bank BRI Syariah	90.97	4	Low Efficiency	100.00	103.31	5.00	2.65
Bank Syariah Mandiri	85.46	5	Low Efficiency	100.00	110.70	4.06	2.60
Bank BNI Syariah	84.61	6	Low Efficiency	100.00	106.84	3.92	3.20

Table 7
Classical Assumption Test Results

The First Regression Model				The Second Regression Model					
Variable		Normality	VIF Multicol-linearity	Variable		Normality	VIF Multicol-linearity	Auto correlation	Sig Hetero-scesdasticity
LASSET	X1	Asymp. Sig. (0.793) > Critical Sig. (0.05), the data is normal	5,180	LASSET	X1	Asymp. Sig. (0.793) > Critical Sig. (0.05), the data is normal	2,664	dU (1.8265) < D (1.849) < 4-dU (2.1735), there is no autoorrelation	0,132
CAR	X2		10,655	CAR	X2		2,045		0,151
NPF	X3		2,306	NPF	X3		2,277		0,314
GCG	X4		1,318	GCG	X4		1,289		0,401
NOM	X5		1,771	NOM	X5		1,149		0,659
FDR	X6		1,040	FDR	X6		1,034		0,644
ETA	X7		19,266						

Table 8
Likelihood Ratio Test And Wald Test Results

Likelihood Ratio Test		Wald Test					
Tobit Regression Data	Table Data	Variable	Coeff.	t (w)	Z_{tabel}	P > | t |	Hypothesis Concl.
Likelihood Ratio (68.95)	X^2 tabel (12.59)	(Constant)	23,366				
Prob > Chi^2 (0.000)	Level Signifikan (α = 0.05)	LASSET	0,895	1,250	1,645	0,219	Rejected
Pseudo R^2 (0.2726)		CAR	0,155	2,130	1,645	0,039	Accepted
Left Censor Data (≥82.76%)	6	NPF	-1,365	-3,110	-1,645	0,003	Accepted
Right Censor Data (≤96.76)	10	GCG	-1,470	-1,190	1,645	0,241	Rejected
Uncensored Data	32	NOM	0,432	3,290	1,645	0,002	Accepted
		FDR	0,694	7,580	1,645	0,000	Accepted

Furthermore, although Bank Size, CAR, NPF, GCG, NOM, and ETA simultaneously have a significant influence on the Efficiency of Islamic Bank Production in Indonesia, the ability of independent variables to explain changes in Production Efficiency in Sharia commercial banks is only 27.26% (Table 7). The table also shows that based on the Wald test, there are four variables that have a significant effect, namely CAR, NPF, NOM, and FDR. While the other two variables namely SIZE and GCG did not have a significant effect on Production Efficiency.

Strengthening CAR indicates an increase in the strength of banks in covering risks and or decreasing the allocation of funds to risky assets. A high CAR will also increase the bank's value so as to facilitate bank operational activities. The results of the study indicate that the increase in capital in Sharia commercial banks is in line with the increase in production efficiency. During the study period sharia commercial banks recorded a high average CAR, exceeding the minimum regulatory limits. The cause of the above conditions is allegedly because Islamic banks consider the capital strength they have to be able to absorb the potential risk of existing assets. Thus giving rise to a decision to increase the allocation of funds to high-risk earning assets, which are expected to provide greater benefits for Sharia commercial banks. Strong capital support can prevent sharia commercial banks from losing money and allocating funds to the right earning assets to increase revenue. The results of this study are supported by Zuhroh, et al (2015), Lema (2017) who also found the significance of the effect of CAR on efficiency as well. Widiarti, et al (2015) and Mongid & Muazaroh (2017) which specifically finds positive significance from the influence of these two variables. Whereas Singh & Fida

(2015) found that strengthening the CAR variable did not significantly cause efficiency performance to increase.

NPF increase indicates an increase in problematic earning assets owned by Sharia commercial banks followed by an increase in reserve reserves, weakening profitability performance, and weakening efficiency performance of sharia commercial banks. The results showed that the success of sharia commercial banks in reducing problem financing had an impact on increasing production efficiency performance. Optimization of input efficiency occurs due to a decrease in the cost of Reserve for Impairment Losses (CKPN) to maintain problem financing. The success in synergizing the quality of human resources, operational systems, and risk management is a combination that is thought to trigger the strengthening of the quality performance of sharia commercial bank assets. So that the financing growth that occurs does not cause an increase in costs. This condition has led to a strengthening in profitability performance and has an impact on the increasing production efficiency of sharia commercial banks. The results of this study are supported by Adusei (2016) who specifically also found a negative signification of the effect of NPF on efficiency. The effect of efficiency was also found in the studies of Zuhroh, et al (2015) and Sufian & Kamarudin (2015), although with positive significance and Widiarti, et al (2015) with the results of research that showed the significance of the effect of NPF on efficiency performance.

An increase in NOM indicates that the bank is able to maintain the cost of funds and increase the income it receives. The results of the study showed that the increase in income obtained by sharia commercial banks was considered able to improve the performance of production efficiency. The financing increase seen from the strengthening of the FDR performance, has a high contribution in increasing the income or profit received by Islamic commercial banks. This condition is supported by an increase in the quality of productive assets, thereby reducing the cost of impairment losses (CKPN), which serves to absorb potential losses from troubled financing. The increase in revenue driven by a decrease in costs triggered a strengthening in NOM's performance which ultimately improved the efficiency of Islamic banks. The results of this study are supported by Singh & Fida (2015) who also found a positive significance of the effect of NOM on efficiency performance. Whereas Widiarti, et al (2015) and Mongid & Muazaroh (2017) found that strengthening NOM performance did not cause significant variations in bank efficiency performance.

The increase in FDR indicates an increase in the optimization of funding sources in Sharia commercial banks. The results of the study showed that the optimization of the source of funds carried out was considered to be able to improve production efficiency. The characteristics of Sharia commercial banks which are still based on income from financing provided are the main trigger for the increase in the amount of financing. The phenomenon of strengthening FDR performance was also followed by the strengthening of NPF performance, which meant that the increase in financing was in line with the increase in the quality of financing provided and resulted in a decrease in credit risk. Thus, Islamic commercial banks will enjoy a higher net profit due to an increase in income that is greater than the increase in costs. This condition has an impact on improving profitability performance which in turn also improves the efficiency of production of sharia commercial banks. The results of this study are supported by Widiarti, et al (2015) who found the significance of the effect of FDR on efficiency performance. Specifically positive significance was found in the Repkova (2015), Singh & Fida (2015), and Lema (2017) studies while the results of Mongid (2016) research found negative significance results.

On the other hand, the bank size (LASSET) and management performance (GCG) is considered to have no effect on variations in the efficiency of production of sharia commercial banks in Indonesia. Conditions in Islamic banks during the study period indicate that an increase in LASSET is considered not able to optimize the increase in production efficiency. Increased bank assets followed by improper use of resources are thought to be the main triggers for slow growth of productive assets that affect profitability performance. The average margin of Islamic bank financing is considered more expensive than the average conventional bank loan interest. This is inversely proportional to the margin / interest for fund raising products. So that people tend to save their funds in Islamic banks and borrow funds through conventional banks.

The condition above certainly causes sharia commercial banks to be burdened with higher DPK fees, but it is difficult to increase profits through financing. So that the increase in assets that occur does not cause sharia commercial banks to enjoy low average costs. As a result, the performance of profitability has not changed significantly, as is the

performance of production efficiency at Islamic commercial banks. The results of this study are supported by Repkova (2015), Zuhroh, et al (2015), Singh & Fida (2015), and Lema (2017) who also found the insignification of the effect of bank size on efficiency. Whereas in management performance, the results of the study show that the application of sharia principles (GCG) is considered to cause a weakening of productive efficiency performance in Sharia commercial banks.

The GCG principles related to the implementation of the duties and responsibilities of the board of commissioners, directors, committees, and sharia supervisory boards, require sharia commercial banks to provide high amounts of basic salaries and benefits. This component is considered to cause input inefficiencies and weaken efficiency performance. So that when Islamic commercial banks do not implement these principles well, it will lead to a strengthening of production efficiency performance due to a decrease in inputs, namely salary costs. The results of this study are supported by Widiarti, et al (2015) who also found that strengthening bank management performance (GCG) did not cause significant variations in efficiency performance.

5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

This research was conducted to obtain the right production efficiency strategy for sharia commercial banks in Indonesia. Efficiency measurements using the SFA frontier approach are then followed by Tobit regression to determine the effect of bank specific characteristics on production efficiency.

The variation in production efficiency in each bank is strongly influenced by the input labor costs (LC), total DPK (DPK), and profit sharing costs (PSC). Income optimization can be done by considering the three input combinations above.

Bank size, CAR, NPF, GCG, NOM, and FDR simultaneously have a significant influence on the Production Efficiency Level in Sharia commercial banks in Indonesia (H_1 accepted). The contribution of the research model to Production Efficiency was 27.26% while the remaining 79.74% was influenced by variables outside the research model. Bank size has a not significant positive effect on the level of production efficiency in Sharia commercial banks in Indonesia during the period 2010 to 2017 (H_2 was rejected). CAR, NOM and FDR partially have a significant positive effect on the Production Efficiency Level at Sharia commercial banks in Indonesia during the period 2010 to 2017 (H_3, H_6, H_7, accepted). NPF has a significant negative effect on the level of production efficiency in Sharia commercial banks in Indonesia during the period 2010 to 2017 (H_4 is accepted). GCG has no significant negative effect on the level of production efficiency in Sharia commercial banks in Indonesia during the period of 2010 to 2017 (H_5 was rejected).

Discussion of the results of the study shows that the determinants of production efficiency variations in Sharia commercial banks during 2010 to 2017 are capital performance (CAR), asset quality (NPF), profitability (NOM), and liquidity (FDR). Whereas from the input side, the most influential towards income sensitivity of sharia commercial banks is labor costs (LC), total DPK (DPK), and profit sharing costs (PSC). The right combination of various aspects above will certainly give birth to the best strategy for developing efficiency performance of sharia commercial banks.

Strengthening production efficiency performance of Islamic banks is strongly influenced by the increase in income received. Because the main source of income for sharia commercial banks is still dominated by the financing provided, the main priority is to improve the quality of financing. This strategy is the optimization of DPK and LC where Sharia commercial banks can increase the number of productive assets (financing), provided that the bank is strongly supported by the operational system and good quality of human resources.

As the frontline of banking, the role of HR is very crucial in order to minimize the risk of existing credit. This means that HR must have high product knowledge and good risk management capabilities to assess prospective debtors. That way, Sharia commercial banks will avoid troubled financing (NPF) and be followed by strengthening profitability performance (NOM) and efficiency performance. Increasing the amount of capital (CAR), will also help Islamic banks in mitigating the potential risk of losses from the financing provided. The second strategy is optimization of DPK and PSC through competitive pricing (rate). Financing rate can be adjusted to market rate so that FDR performance is strengthened through increased financing. Optimization can also be done from the side of DPK by slightly reducing the level of profit sharing, thereby reducing operational costs. This condition will have an impact on strengthening NOM's performance due to a surge in margins in line with the decrease in costs.

Because of the limitations of the study, the next researcher can expand in various ways. First, if you continue to use Islamic banks as research subjects,

further researchers may consider adding other types of Islamic banks such as Sharia Business Units (UUS) and Sharia Regional Development Banks (BPRS) in the population and research samples. It can also be supported by a longer research period, for example by using quarterly or semester periods. So it is expected that the amount of data (n) obtained will increase. Second, further researchers should concentrate on significant variables in this study and can add bank external variables as independent variables. So that it is expected to increase the value of the contribution of the research model.

REFERENCES

Adusei, Michael. 2016. Determinants of Bank Technical Efficiency : Evidence from Sural and Community Banks in Ghana.Adusei, *Cogent Business & Management.* Vol.3. 1-15

Aigner, D et al. 1977. Formulation and Estimation of Stochastic Frontier Production Function Models. *Journal of Econometrics* 6: 21-37

Aisy, Diamantin Rohadatul and Mawardi, Imron. 2016. Faktor – Faktor Yang Mempengaruhi Pertumbuhan Aset Bank Syariah Di Inonesia Tahun 2004-2015. *Jurnal Ekonomi Syariah Teori dan Perbankan*. Vol.3, No.3. 249-265

Berger, A. N. and Mester, L. J. 1997. Efficiency and productivity cdhange in the U.S. commercial banking industry: a comparison of the 1980s and 1990s. *Working Papers* 97-5. Federal Reserve Bank of Philadelphia.

Berger, A. N. and Humphrey, D. B. 1997. Efficiency of Financial Institutions: International Survey and Directions for Future Research. *Journal of Operational Research*

Cooper, Donald. R and Schindler, Pamela. S. 2014. *Business Research Methods*. New York: McGraw-Hill

Gayval, Bhagat K and V H Bajaj. 2015. Measuring Efficiency of Indian Banks: A DEA-Stochastic Frontier Analysis. *International Journal of Innovative Research in Science, Engineering and Technology. V*ol. 4, Issue 12. 12602-12808

Gunawan, Firman Aji. 2013. Analisis Tingkat Efisiensi Bank BUMN dengan Pendekatan Data Envelopment Analysis (DEA). *Jurnal Ilmu & Riset Manajeme.* Vol. 2 No. 8, 1-17

Kasmir, 2012. *Manajemen Perbankan Edisi Revisi* 2008. Cetakan Kesebelas. Jakarta :PT. Raja Grafindo Persada.

Lema, Tadasse Zenebe. 2017. Determinants of Bank Technical Efficiency: Evidence from Commercial Banks in Ethiopia. *Cogent Business & Management.* Vol.4. 1-13

Mongid, Abdul. 2016. Business Efficiency of The Commercial Bank in ASEAN. Investment Management and Financial Innovations.Vol.13, Issue 1. 67-76

____and Muazzaroh. 2017. The Efficiency and Inefficiency of the Banking Sectors: Evidence from Selected ASEAN Banking. *Jurnal Ekonomi Malaysia.* Vol.51. 119-132

Otoritas Jasa Keuangan. Laporan Keuangan Publikasi Bank, (Online). (http://ojk.go.id/, accessed on l 01 November 2017)

____Direktori Perbankan Indonesia 2017, (Online). (http://ojk.go.id/, accessed on 23 July 2018)

____Direktori Perbankan Indonesia 2016, (Online). (http://ojk.go.id/, accessed on 23 July 2018)

Rahmawati, Rafika. 2015. Strategi Peningkatan Efisiensi pada Bank Umum Syariah Berbasis Stochastic Frontier Approach da Data Envelopment Analysis. *Buletin Ekonomi Moneter dan Perbankan*.Vol. 17, No. 4. 457-480

Repkova, Iveta. 2015. Banking Efficiency Determinants in the Czech Banking Sector. *Procedia Economics and Finance.* Vol.23.191 – 196

Ruslan, Rosady. 2010. *Metode Penelitian Public Relations dan Komunikasi* Jakarta : PT. Raja Grafindo Persada

Sanusi, Anwar. 2013. *Metodologi Penelitian Bisnis*. Jakarta : Salemba Empat.

Shawtari, Fekri Ali, et al. 2015. Efficiency Assessment of Banking Secor in Yemen Using Data Envelopment Window Analysis : A Comparative Analysisi of Islamic and Conventional Banks. *An International Journal*. Vol. 11, Iss 6. pp.1115-1140

Singh, Dharmendra and Fida, Bashir Ahmad. 2015. Technical efficiency and its determinants: an empirical study on banking sector of Oman. *Problems and Perspectives in Management*. Vol. 13, Issue 1. 168-175

Sufian, Fadzlan and Kamarudin, Fakarudin. 2015. Determinants of Revenue Efficiency of Islamic Banks : Empirical Evidence from the Southeast Asian Countries. *International Journal of Islamic and Middle Eastern Finance and Management.*Vol.8, No.1. pp. 36-63

Surahno, Arfinda Piradipta et al. 2014. AnalisisEfisiensi Bank Umum Sebelum dan Setelah Krisi Ekonomi 2008 dengan Menggunakan Metode Non Parametrik Data Envelopment Analysis (DEA). *Diponegoro Journal Of Management. V*ol. 3, No. 3. 1-15

Tahir, Izah Mohd et al. 2012. The Determinant of Bank CostInefficiency in ASEAN Banking.

Jurnal Pengurusan. Vol.36, pp 69-76

Tjondro, David and R. Wilopo. 2011. Pengaruh Good Corporate Governance (GCG) Terhadap Profitabilitas Dan Kinerja Saham Perusahaan Perbankan Yang Tercatat Di Bursa Efek Indonesia (BEI). *Journal of Business and Banking*. Vol.1, No.1, pp 1-14

Wahab, Abdul. 2014. Analisis Faktor – Faktor yang Mempengaruhi Efisiensi Bank Umum Syariah di Indonesia dengan pendekatan Two Stage Stochastic Frontier Approach (SFA). *Jurnal Pemikiran dan Penelitian Ekonomi Islam* (Econimoca).Vol. VI, No. 2. 57-75

____et al. 2014. Komparasi Efisiensi Teknis Bank Umum Konvensional (BUK) dan Bank Umum Syariah (BUS) di Indonesia dengan Metode Data Envelopment Analysis (DEA). *Jurnal Al-Iqtishad.* Vol. VI, No. 2. 179-194

Widiarti, Astoeti Wahjoe et al. 2015. Determinants of Bank's Efficiency in Indonesia. *Bulletin of Monetary, Economics and Banking*. Vol.18, No.2, 121-145

Zuhroh, Idah et al. 2015. Cost Efficiency of Islamic Banks in Indonesia – A Stochastic Frontier Analysis. *Procedia-Social and Behavioral Sciences.* Vol. 211. 1122-1131